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FACULTY WORKING  
PAPER NO. 908

Measuring Current Costs of Technologically  
Inferior Assets

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Measuring Current Costs of Technologically  
Inferior Assets

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## Abstract

Recent accounting standards require disclosures of current costs of fixed assets even when the owned asset has been superseded in the market by a technologically superior asset. Although four types of technological change are possible, the standards contain explicit rules for valuing only two types of change. Weil's valuation rules extend and improve upon the official rules by giving explicit recognition to the time value of technological differences. This paper suggests that Weil's rules can be further improved by giving greater attention to usability of technological differences and by considering relative risk in the selection of discount rates. The result of these modifications is a conceptually superior rule and two practical equivalents, each of which is applicable to any and all types of technological change.

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MEASURING CURRENT COSTS OF TECHNOLOGICALLY  
INFERIOR ASSETS

Standards for current-cost disclosures in several countries now require measurements of the effects of technological change. The standards discuss three or four such changes, but explicit valuation rules are shown for no more than two changes. For other changes, little guidance is given about how the measurements should be made, except that they might involve the use of compound-interest techniques. In general, accounting literature does not offer much additional guidance.

An exception is the work of Weil [1976], who offers a set of six valuation rules for various simple and complex changes in technology. These rules are helpful because Weil is explicit about when and how compound-interest calculations are to be made. They are conceptually superior to simpler rules implied by the above standards, but they also have weaknesses that require resolution.

This paper analyzes Weil's valuation rules with the goal of improving their internal validity and extending their applicability. The proposed revisions shift the focus from divisibility to usability of technological improvements, and they support the use of a risk-adjusted discount rate rather than an aggregate rate such as the firm's cost of capital. These arguments are used to derive three valuation rules, each applicable to all types of technological change. The rules are mathematically equivalent, but they are expressed in terms of different variables that would be more or less difficult to estimate in different practical situations.

It is assumed throughout this paper that one can determine the current cost of any asset that is available through normal markets for



new assets. The problem is that the available data may not include the cost of an asset just like the one owned. The only available replacement may have one or more differences in service potential due to changes in technology. Such a situation causes difficulties in valuing the firm's inferior-but-still-useful assets. It is these difficulties that are analyzed below.

### The Official Rules

Standards for current-cost accounting [ICAA/ASA, 1978; FASB, 1979; ASC, 1980] list four types of technological change whose effects are to be measured:

- (1) change in capacity as quantity of periodic output;
- (2) change in capacity as quality of periodic output;
- (3) change in economic life; and
- (4) change in operating costs.

The valuation rule most commonly found in these standards, i.e., SSAP-16 [ASC, 1980, p. 136], applies only to the first type of change:

$$C_e = C_r (Q_e / Q_r)$$

where  $C_e$  = current cost of existing service potential

$C_r$  = current cost of a replacement with higher physical output ( $Q_r$ ).

The Australians have a rule [ICAA/ASA, p. 12] for a combination of types (1) and (3):

$$C_e = C_r (Q_e / Q_r) (n/m)$$

where  $n$  = existing asset's useful life in years

$m$  = replacement's useful life in years.

The latter rule implies that a simple change in life, type (3), would be measured by

$$C_e = C_r (n/m).$$

No explicit valuation rules are given for types (2) and (4). The ASC says that type (4) is more difficult because it may require discounting [p. 136]. The FASB [p. 65] discusses discounting but does not encourage its use.

Without discounting, however, one is left with naive approaches that are likely to yield misleading results. For example,  $C_e$  would most certainly be undervalued if one were simply to reduce  $C_r$  by the total cost savings that would accrue over the full life of the replacement. Surely the value of those cost savings would be effected by the time-value of money. Moreover, it would be incorrect to estimate  $C_e$  at half the cost of a replacement whose economic life is twice that of the owned asset. An asset that produces the same cash flows for twice as many years is not worth twice as much because the later cash flows are worth less presently than the earlier flows. If based on such naive rules, reported amounts could be significantly misleading.

In contrast to these official standards, Weil has developed a set of valuation rules that include specific discounting techniques to recognize the time-value of money. His work is criticized below, but it is also acknowledged that it is superior to what others have accomplished in this area. It is unlikely that we would have made much progress without the foundation his work provides.

## DIVISIBILITY AND USABILITY

In modified notation, Weil's rules are shown in Exhibit 1. He first discusses four types of technological change, as separate from each other, and then presents two comprehensive rules for complex changes in technology. The principle topic of this section is the need to focus on usability of technological changes rather than "divisibility."

### Focus on Usable Efficiency

Weil distinguishes changes in operating capacity as "divisible" or "indivisible":

The replacement asset is divisible if we can acquire a fraction of it [70 percent in Weil's examples] with all costs proportionately reduced [or] if we have ten of the existing assets which can be replaced with seven of the replacement assets [p. 93].

Otherwise, the replacement is indivisible and "the multiplication by .70 should be omitted." [p. 93] Weil's rule (1) for divisible assets is the same as the example shown by the Accounting Standards Committee for (presumably) all changes in operating capacity.

Rule (1) is valid, but it must be used with great caution. It is valid for a simple technological change in the quantity of periodic output. It is not appropriate when there is a difference in quality of output, economic life or operating cost per unit. If there is also a difference in efficiency (cost per unit), one should use a rule appropriate for a complex change in technology.

The importance of the latter point is demonstrated with the facts from Weil's Case II:

	$c = 10\%$
$Q_r = 1,000$ units	$Q_e = 700$ units
$E_r = \$1,100$	$E_e = \$1,100$
$m = 10$ years	$n = 10$ years
$C_r = \$20,000$	$C_e = \text{unknown.}$

Based on these facts, Weil [1976, p. 93] uses rule (1) to get

$$\begin{aligned} C_e(1) &= \$20,000(700/1,000) \\ &= \$14,000, \end{aligned}$$

for a divisible change in capacity. This may seem to be the correct valuation, but it is not. Weil's assumption is that the firm could have the same output by replacing ten existing assets with seven improved assets, and we accept that. Notice, however, that rule (1) ignores the fact that such equal output would be produced more efficiently. Total operating costs would be \$7,700 with the replacements, \$3,300 less than operating costs with ten existing assets. Given that the more efficient machines are worth \$140,000, the existing machines must be worth less than \$14,000 each because they are less efficient than the replacements. A better estimate is provided by rule (5):

$$\begin{aligned} C_e(5) &= 6.14457[(\$20,000/6.14457 + \$1,100)(700/1,000) - \$1,100] \\ &= \$11,972. \end{aligned}$$

Weil's facts actually represent a complex change for which rule (1) is inappropriate.

Rule (1) would be valid only if the replacements were equally efficient, i.e.,  $E_r/Q_r = E_e/Q_e$ . In that case, Weil's facts would need to be modified so that  $E_r = \$1,571.43$  to make the total cost of operating seven newer units equal \$11,000 per year. Given that modification, we can reconcile rule (1) with rule (5):

$$\begin{aligned} C_e(5) &= 6.14457 [(\$20,000/6.14457 + \$1,571.43)(700/1,000) - \$1,100] \\ &= \$14,000, \end{aligned}$$

Rules (1) and (5) produce consistent results only when the replacement is equally efficient.

Unfortunately, rule (6) is not valid for either level of efficiency. Rule (6) is intended to be used for "indivisible" changes where the firm can use only part of the replacement's capacity, 7/10 of designed capacity in Weil's example. Given that the replacement is equally efficient, rule (6) would yield:

$$\begin{aligned} C_e(6) &= 6.14457 [\$20,000/6.14457 + \$1,571.43 - \$1,100] \\ &= \$22,897, \end{aligned}$$

This valuation is obviously wrong because the existing asset cannot be worth more than a replacement with higher capacity. There is also an error when Weil's original facts are used. He gets \$20,000 using rule (2), and rule (6) yields the same result:

$$\begin{aligned} C_e(6) &= 6.14457 [\$20,000/6.14457 + \$1,100 - \$1,100] \\ &= \$20,000. \end{aligned}$$

The problem here is that the existing asset cannot be worth as much as the replacement because the existing asset is less efficient. Weil's results in Case V [p. 96] are also based on  $E_r$  at full capacity even though he assumes only 70% of that capacity would be used.

To eliminate this weakness of rule (6),  $E_r$  must be redefined. It is usable efficiency that is relevant to the valuation, which means that attention must be given to operating costs that would be required at usable capacity. If the replacement can produce 1,000 units at a cost of \$1,100, it can surely produce 700 units for less than \$1,100. Most of the operating costs would vary with output (direct materials, direct labor, energy usage, etc.), but total costs would be somewhat higher than \$770 (70% of \$1,100) because of fixed costs such as insurance. Assuming that the redefined  $E_r$  is determined to be \$800, the modified rule (6') yields

$$\begin{aligned} C_e(6') &= 6.14457[\$20,000/6.14457 + \$800 - \$1,100] \\ &= \$18,157. \end{aligned}$$

This is a more plausible estimate than \$20,000 because the existing asset is obviously worth less than the more efficient replacement.

#### Focus on Usable Life

But rule (6) has another weakness that also results from a focus on divisibility rather than usability of the replacement's operating capacity. In the indivisible case, Weil says that a reported valuation of \$20,000 should be accompanied by a note explaining that

the replacement cost assumes acquisition of capacity 10/7 as large as existing capacity, but that this extra capacity would not be used for the foreseeable future [p. 93, emphasis added].

Both the valuation and its justification are based on a narrow interpretation of "usability" in the sense of usable periodic capacity.

This interpretation ignores the possibility that lower periodic usage could extend the number of periods of usage.

For many assets, economic life is more dependent on the rate of usage than the passage of time. If the superior asset will operate at 100 percent of designed capacity for ten years, it is very likely that it could be operated at 70 percent of capacity for more than ten years. It may not last a full 14.3 years,  $10(10/7)$ , but it might easily last 12 years at 70 percent of designed capacity. If this is the way the replacement would be used (and perhaps will be used), it would be sensible for the firm to estimate the extent to which lower usage would extend the asset's life in terms of years.

Thus, our second modification of rule (6) is to redefine "m" as the usable life of the replacement (as it would be used by this firm). If the usable life is 12 years, the revised rule (6'') would yield

$$\begin{aligned} C_e(6'') &= 6.14457[\$20,000/6.81369 + \$800 - \$1,100] \\ &= \$16,193. \end{aligned}$$

This estimate is even more plausible than the last one because the existing asset has a shorter usable life as well as lower efficiency. Because it is inferior in two ways, the existing asset should be worth significantly less than the replacement.

We now have two rules that produce plausible results: rule (5) and rule (6''). The four simple rules are not discussed further because their applicability would be very limited. Indeed, even what seemed



at first to be a simple change in operating capacity was actually a complex change in usable technology. Rules (5) and (6") have thus far produced plausible valuations, but can they be relied on to produce correct valuations?

#### AGGREGATE AND RISK-ADJUSTED RATES

The answer depends primarily on whether  $c$  (cost of capital) percent is the correct discount rate. More precisely, it depends on whether  $c$  is the correct discount rate for both assets. Most textbooks on economics and finance tell us that the theoretically correct answer would be the present value of cash flows from the owned asset, discounted at the rate appropriate for its category of risk. Otherwise identical assets with different lives would most likely be perceived as different in riskiness, if for no other reason than the increased probability of obsolescence with a longer-lived asset. We attempt to demonstrate below that Weil is implicitly discounting the cash flows of both assets by the same inappropriate rate.

#### Reverse Logic

Weil's rules seem to ignore net cash flows ( $F$ ) and gross receipts ( $R$ ), but there is a sense in which both are implied. This can be seen by rearranging rule (5). If  $c$  is the appropriate rate for the replacement's category of risk (i.e., its implicit rate of return) then

$$C_r / P_{c,m} = F_r$$

$$\begin{aligned}
 \text{so that } C_e(5) &= P_{c,n} [(C_r/P_{c,m} + E_r)(Q_e/Q_r) - E_e] \\
 &= P_{c,n} [(F_r + E_r)(Q_e/Q_r) - E_e] \\
 &= P_{c,n} [R_e(Q_e/Q_r) - E_e] \\
 &= P_{c,n} (R_e - E_e) \\
 &= P_{c,n} (F_e).
 \end{aligned}$$

This would be the correct value for the owned asset only if  $c$  is the risk-adjusted rate for an asset with an  $n$ -year life. In order to get this result, however, it was necessary to assume that  $c$  was appropriate for an  $m$ -year life. The argument is invalid; by reductio ad absurdum,  $c$  cannot be appropriate for both assets when  $m > n$ .

Furthermore,  $c$  is unlikely to be appropriate for either asset. Weil's approach is backward from the normal approach in that he infers  $F_e$  from  $F_r$ , which is inferred from  $C_r$  and  $c$ . Theoretically, one would need to know  $F_e$  and the risk-adjusted rate ( $r'$ ), which would be inferred from  $n$ ,  $m$  and the replacement's implicit rate ( $r$ ), which is determined by  $C_r$  and  $F_r$ . Since we are concerned with risky assets, we would most likely find that  $r > r' > c$ . (If  $m < n$ , the expectation is  $r' > r > c$ .)

#### Theoretical Solution

Application of the theoretical solution would not always be possible in practice, but it is useful to consider here for two reasons. First, it allows us to test the validity of Weil's rules and to clarify any weaknesses therein. Second, it allows us to derive theoretically sound rules that are less sensitive to errors in estimates of  $r'$  and  $F_e$ .

The theoretical sequence requires knowledge of several items of information that Weil's rules ignore. Given perfect knowledge, we supply additional items in Exhibit 2 that are consistent with Weil's case for the "indivisible" replacement. Exhibit 2 shows the calculations that would be made as a result of this sequence:

- (1) Determine the net cash flows that would be generated by the owned asset for  $n$  years if it were in its original condition.
- (2) Determine the cash flows that would be generated by the replacement as it would be used by the firm.
- (3) Find the replacement's implicit rate of return ( $r$ ) based on its economic life as it would be used by this firm ( $m$ ).
- (4) Find the risk-adjusted rate for an  $n$ -year life ( $r'$ ) by determining the risk-premium associated with  $m > n$  years of life to get  $P_{r',n}$ .
- (5) Find  $C_e = F_e(P_{r',n})$ .

Given perfect knowledge of all conditions, which we are fortunate enough to have at this point, \$17,681 would be the current cost of the owned asset if identical assets were still on the market.

#### Aggregate Rates Are Inappropriate

The correct result can only be obtained when cash flows are discounted by the risk-adjusted rate. Cost of capital and the firm's overall return on investment are inappropriate because they are aggregate rates. They are determined by total returns from risky and less risky (more liquid) assets and by borrowing rates. Aggregate rates may be appropriate for aggregate valuation, but they are inappropriate for valuation of individual assets.  $F_e$  is an incremental cash flow from a risky asset, and it would be conceptually inconsistent to discount those flows by anything but the incremental rate of return for assets of similar riskiness.

The latter statement does not contradict the usefulness of modern capital-budgeting techniques. Net present-value analysis makes use of a "target rate," which may be based on the firm's cost of capital, but the results would be misleading if the target rate equals  $c$ . If so, the replacement would be valued at

$$\begin{aligned} PV &= \$3,689.61(6.14457) \\ &= 22,672 \end{aligned}$$

and  $NPV = \$2,672$ .

PV is not the asset's value, however, and the firm would not gain NPV by purchasing it. NPV is simply the present value of future incremental returns in excess of  $c$ . To achieve an aggregate target of  $c$ , the firm must earn more than  $c$  on risky assets. That is why capital budgeting also involves estimation of implicit (or "internal") rates of return.

Purchasing a replacement with the highest implicit rate is logically equivalent to replacing operating capacity at the lowest cost. Weil says we want to know the lowest cost of replacing the owned asset's operating capacity including the present value of future cost savings [pp. 90-91]. We agree, with the comment that this requires use of the risk-adjusted rate of return.

#### EXTENDED RULES

Because this is more easily said than done, we add two valuation rules that are less sensitive to errors in estimating  $P_{r,n}$  or  $F_e$ . In addition to the theoretical rule, Exhibit 3 shows two other rules that

can be used for all types of technological change. The additional rules are mathematically equivalent to the theoretical rule. The proportional-flow rule,

$$\begin{aligned} C_e &= C_r (P_{r',n} / P_{r,m}) (F_e / F_r) \\ &= (F_e / F_r) (C_r / P_{r,m}) P_{r',n} \\ &= (F_e / F_r) (F_r) P_{r',n} \\ &= F_e (F_r / F_r) P_{r',n} \\ &= F_e (P_{r',n}) \end{aligned}$$

The incremental-flow rule,

$$\begin{aligned} C_e &= C_r (P_{r',n} / P_{r,m}) - (F_r - F_e) P_{r',n} \\ &= (C_r / P_{r,m}) P_{r',n} - (F_r - F_e) P_{r',n} \\ &= (C_r / P_{r,m} - F_r + F_e) P_{r',n} \\ &= (F_r - F_r + F_e) P_{r',n} \\ &= F_e (P_{r',n}) \end{aligned}$$

Thus they would be equally useful in the unlikely event that managers had perfect knowledge of all the indicated variables. The reason for alternate specifications is the general unavailability of perfect knowledge in practice.

### Minimizing Errors of Estimation

The proportional-flow rule should be used when managers are reasonably confident of the amount of proportional flows but not so confident of absolute flows or  $r'$ . This rule can be used when cash flows vary over time, provided that they vary in approximately the same proportion. Of the three extended rules, the proportional-flow rule is the least sensitive to errors in estimating the discount rates. For example, if it were known that  $F_e/F_r = .9187$  in the preceding case but the discount rates were underestimated by 3% each,  $E(r) = 12\%$  and  $E(r') = 11\%$ , the proportional-flow rule would give managers

$$\begin{aligned} E(C_e) &= \$20,000 (5.88923/6.19437) (.9187) \\ &= \$17,469, \end{aligned}$$

which is only 1.2% less than the actual value of \$17,681. In cases where the replacement has the same life as the owned asset ( $m = n$ ), the reliability of this rule is not affected by ignorance of  $r'$ .

The incremental-flow rule is more sensitive to errors in estimating  $r'$ , but less so than the absolute-flow rule. Suppose managers in the above example are confident that the replacement could save \$300 per year, but they underestimated  $r$  and  $r'$  by 3 percent as in the last example. They would get

$$\begin{aligned} E(C_e) &= \$20,000(5.88923/6.19437) - \$300(5.88923) \\ &= \$17,248 \end{aligned}$$

which is \$433 too low, an error of 2.4 percent. In contrast, if they used the same estimate of  $r'$  with the absolute-flow rule, they would get

$$\begin{aligned} E(C_e) &= \$3,389.61(5.88923) \\ &= \$19,962, \end{aligned}$$

which overestimates the actual value by 12.9 percent. The incremental-flow rule can also be used for variable cash flows, provided that their differences are approximately constant over time. In the event that differences vary significantly, the rule can be adapted to discount each year's difference by the present value of \$1, for 1 to n years. The same modification would probably be needed more often for the aggregate-flow rule, either due to declining output and/or increasing operating costs.

#### Comparison with Other Rules

We offer these rules as an improvement on Weil's work, just as three of his rules improve on naive rules of the standard-setters. His rule (1) is the same as theirs for a simple change in capacity, but as explained below, it is almost certain that his rules (3) through (5) would yield more reliable results than the naive rules.

Weil's major contribution is his recognition that a difference in service potential is something broader than the difference in total units producible; it is the discounted value of the different potential that matters. For that reason, his rule (3) for a difference in operating costs and rule (4) for a difference in economic lives are definite improvements on the naive rules. Even a risk-free rate would be better than no discounting at all. Since both of these improvements are incorporated in Weil's rule (5), that rule would be significantly more reliable for a combined change in operating cost and economic life.



Our recommendation would extend rule (5) in four ways. By focussing first on differences in operating costs and economic lives at usable capacity, the redefinition of  $E_r$ ,  $m$ , and  $Q_r$  effectively replaces Weil's quantity term in rule (5), making rule (5') identical to rule (6''):

$$\begin{aligned} C_e (5') &= P_{c,n} [C_r / P_{c,m} + E_r - E_e] \\ &= C_r (P_{c,n} / P_{c,m}) + (E_r - E_e) P_{c,n} \\ &= C_r (P_{c,n} / P_{c,m}) - (E_e - E_r) P_{c,n}. \end{aligned}$$

The second modification is to use discount rates that are risk-adjusted:

$$C_e (5'') = C_r (P_{r',n} / P_{r,m}) - (E_e - E_r) P_{r',n}.$$

The third modification is to extend the rule to cover differences in quality as well as quantity of output. With higher quality,  $R_r - R_e$  has the same effect on valuation as  $E_e - E_r$ . Both differences have the same effect on net cash flows, and the total effect is

$$(R_r - R_e) + (E_e - E_r) = (R_r - E_r) - (R_e - E_e) = F_r - F_e,$$

so that rule (5'') can be broadened to

$$C_e (5''') = C_r (P_{r',n} / P_{r,m}) - (F_r - F_e) P_{r',n},$$

which is the incremental-flow rule for all four changes: quantity, quality, life and operating cost. The fourth extension is to offer the valuation rule in three forms, allowing a choice of form that best fits the most reliable data available in a particular case.

SUMMARY

The valuation rules shown in Exhibit 3 are an improvement on Weil's rules, which are an improvement on the rules expressed or implied by standard-setters. The strength of Weil's rules is their explicit recognition of the time-value dimension of different service potentials due to technological differences. We attempt to build on that strength by giving more attention to the usability of technological changes and by giving recognition to the relative riskiness of fixed assets in the selection of discount rates. In addition to providing for differences in the quality of output, our extensions permit the minimization of valuation errors by choosing one of three rules that uses the most reliable estimates available in a given case.

In spite of our criticism, we recognize Weil's work as a contribution to progress in this area. Any value that our work contributes is largely the result of having something upon which to build. Weil's work provided the necessary foundation.

WEIL'S RULES FOR MEASURING REPLACEMENT COSTS  
WITH CHANGES IN TECHNOLOGY

<u>Change</u>	<u>Measurement Rule</u>
(1) Divisible capacity:	$C_e = C_r(Q_e/Q_r)$
(2) Indivisible capacity:	$C_e = C_r$
(3) Operating cost:	$C_e = P_{c,n}(C_r/P_{c,n} + E_r - E_e)$
(4) Economic life:	$C_e = P_{c,n}(C_r/P_{c,m})$
(5) Divisible combination:	$C_e = P_{c,n}[(C_r/P_{c,m} + E_r)(Q_e/Q_r) - E_e]$
(6) Indivisible combination:	$C_e = P_{c,n}[C_r/P_{c,m} + E_r - E_e]$

where:  $C_e$  = current replacement cost of existing productive capacity of the owned asset (in original condition)

$C_r$  = current cost of the lowest-cost replacement for the owned asset

$P_{c,n}$  = present-value factor for an annuity earning rate  $c$  for  $n$  years

$c$  = the firm's cost of capital (as an annual rate)

$n$  = original life of owned asset

$m$  = life of replacement

$E$  = annual cost of operating asset  $e$  or  $r$

$Q$  = periodic physical capacity of asset  $e$  or  $r$

THEORETICAL SOLUTION FOR CASE OF  
"INDIVISIBLE" REPLACEMENT

	(1) <u>Owned</u>	Capacity <u>Adjustment</u>	(2) <u>Replacement</u>
Annual receipts (R)	\$4,489.61	(700/700)	4,489.61
Less expenditures (E)	<u>(1,100.00)</u>	*	<u>(800.00)</u>
Net cash flows (F)	<u>\$3,389.61</u>		<u>\$3,689.61</u>

\*70 percent of replacement's variable costs at designed capacity  
(\$1,000) plus fixed costs (\$100).

$$(3) P_{r,12} = \$20,000 / \$3,689.61 = 5.42063$$

r (from present-value tables) 15%

$$(4) \text{ Less risk-premium for } m > n \text{ years } \quad \underline{(1\%)}$$

$$r' \quad \underline{\underline{14\%}}$$

$$P_{r',10} \text{ (from present-value tables)} \quad 5.21612$$

$$(5) C_e = \$3,389.61(5.21612)$$

$$= \$17,681$$

EXTENDED VALUATION RULES FOR  
ALL CHANGES IN TECHNOLOGY

Absolute-Flow Rule:  $C_e = F_e(P_{r',n})$

Proportional-Flow Rule:  $C_e = C_r(P_{r',n}/P_{r,m})(F_e/F_r)$

Incremental-Flow Rule:  $C_e = C_r(P_{r',n}/P_{r,m}) - (F_r - F_e)P_{r',n}$

where  $C_e$  = the lowest cost of replacing the owned asset's original service potential

$C_r$  = current cost of the lowest-cost replacement for the owned asset

$F$  = annual net cash flow at usable capacity of asset e or r

$P_{r',n}$  = present-value factor(s) for the replacement's implicit rate of return for n years, risk-adjusted ( $r'$ ) if  $n < m$

$n$  = original economic life of owned asset

$m$  = economic life of the replacement when operated at usable capacity

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